Uptake of Ethyl Alcohol Vapor in Sulfuric Acid Solutions

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Abstract

The uptake of ethyl alcohol vapor in liquid sulfuric acid has been investigated over the composition range of 40 - 80 wt % H_2SO_4 and between the temperatures of 193-273 K. Laboratory studies were performed using a flow-tube reactor coupled to an electron-impact ionization mass spectrometer for detection of ethanol and possible reaction products, ethyl hydrogen sulfate and diethyl sulfate. The uptake coefficients (gamma) have been measured and found to vary from 0.018 to 0.065, depending upon the acid composition and temperature. At concentrated acids greater than 70 wt % and dilute solutions (<70 wt %) colder than 210 K, the gamma values are approaching 0.06. Under other conditions, the gamma values are smaller. The adsorption and thermal desorption measurements have been used to distinguish the possible uptake mechanisms, either solubility or reactive uptake. The results suggest that reactive uptakes are greater than 50 % under all conditions. For dilute acids, we also determine the effective Henry's law constants (H*). We will compare the results with the uptake of methyl alcohol and acetone in H_2SO_4 determined previously in our laboratory. The potential implications to the budget of ethyl alcohol in the global troposphere will also be discussed.